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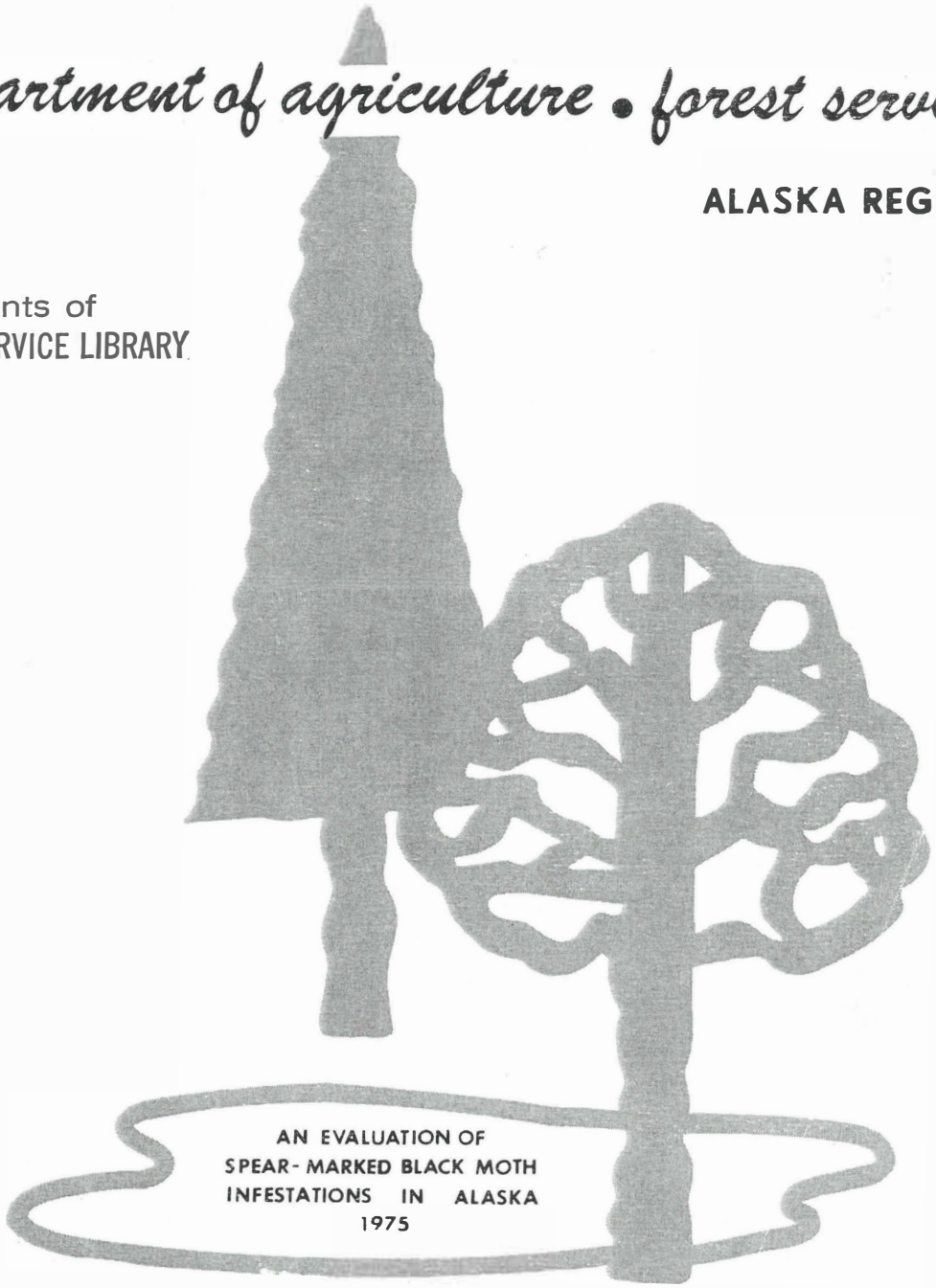
ALASKA REGION



AN EVALUATION OF
SPEAR-MARKED BLACK MOTH
INFESTATIONS IN ALASKA
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by

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ACKNOWLEDGMENTS

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ABSTRACT

An evaluation of spear-marked black moth infestations in southcentral and interior Alaska was conducted during August and September 1975. Aerial surveys revealed that 1.1 million hectares (2.7 million acres) of paper birch in pure and mixed birch-white spruce forests along portions of the Tanana and Yukon Rivers had been visibly defoliated. Pupal surveys conducted in the Interior showed significant reductions (7.4 pupae per square meter in 1975 vs. 24.4 pupae per square meter in 1974) in spear-marked black moth populations. The sudden decline and population levels is due primarily to increased larval parasitization and disease. Populations will probably return to innocuous levels over most of the area in the Interior. The southcentral outbreak near Talkeetna may continue for another season.

INTRODUCTION

The spear-marked black moth, *Rheumaptera hastata* (L.), is a hardwood defoliator commonly found in Alaska. Paper birch, *Betula papyrifera* Marsh., is the preferred host, but the moth also feeds on species of alder, *Alnus* sp. and willow, *Salix* sp. This insect, unlike most other hardwood defoliators, does not consume entire leaves. The larvae feed only on the upper surface of the leaves which subsequently become desiccated and curled. The reddish-brown discoloration which accompanies desiccation varies with the degree of feeding.

The spear-marked black moth has a one-year life cycle in Alaska. It overwinters in the pupal stage in the leaf litter and moss beneath the host tree. Adult moths begin emerging in late May and emergence continues through mid-June when the adults are most plentiful (Downing 1958). Egg-laying starts in early June with the females ovipositing on the leaves of birch and alder. The larvae begin hatching and start feeding in mid-June. Feeding and larval development continues until early August when the caterpillars lower themselves to the ground on silken threads and pupate in the forest litter.

The spear-marked black moth has been recorded at outbreak levels only once prior to the current infestations. In that outbreak, which occurred during 1957-58, 134,700 hectares (333,000 acres) of paper birch in pure and mixed paper birch-white spruce, *Picea glauca* (Moench) Voss, stands were severely defoliated (Downing 1958). The overall area of the outbreak was about 2.3 million hectares (5.8 million acres) and generally followed the Tanana and Yukon River drainages. The populations, first reported in August 1957, built up very rapidly and remained at high levels through the summer of 1958. However, larval parasitoids and diseases caused a rapid decline and populations returned to endemic levels in 1959 (Downing 1959).

The current outbreak was first reported in 1974 following a rapid buildup from 1973 (Baker et al. 1974). Because of continued heavy feeding in 1975, cooperative aerial surveys and ground investigations were made to determine the extent of the area affected and population trends of the insect.

METHODS

Low level, aerial sketch-mapping surveys were conducted in 1975 during August 11-20 for the interior populations and on September 7 for the southcentral populations. Mapping was done on USGS topographic quadrangle maps, 1:250,000 scale.

Pupal surveys to assess overwintering populations were made during September 9-11, 1975. Samples were taken at 24 locations distributed throughout most of the outbreak area in interior Alaska (Maps 1-5). Three square-meter

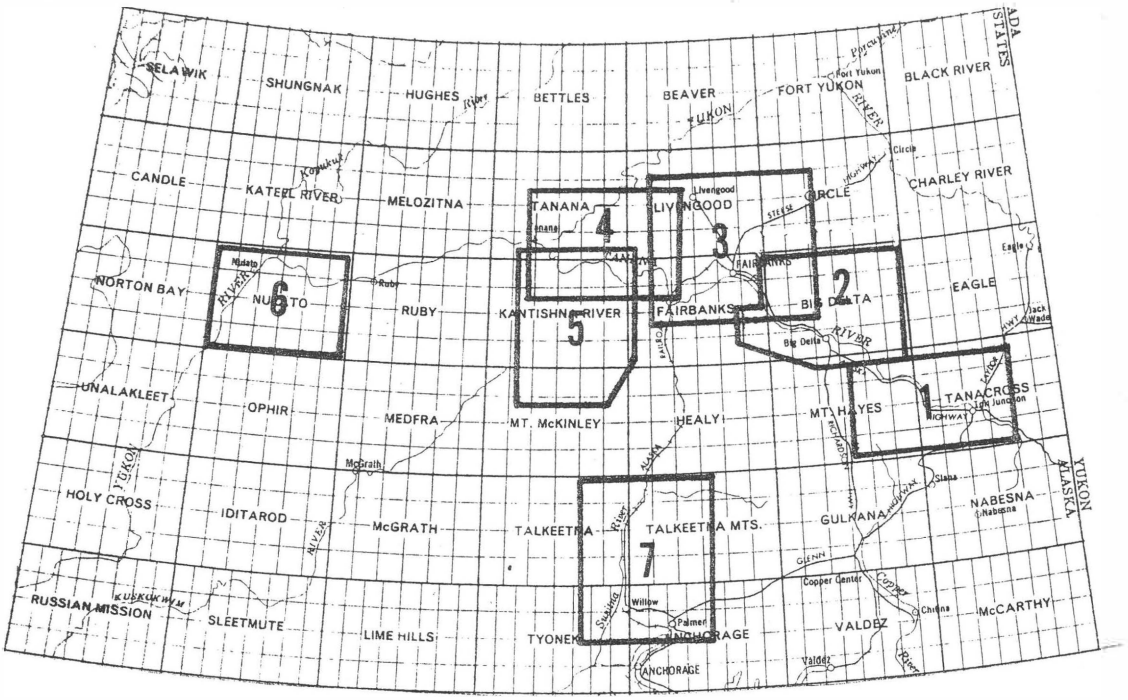
samples located 9.1 meters (30 feet) apart were taken at each location. All of the leaves, moss, and other litter within each square-meter sampling area were removed and placed in a plastic bag. The material was carefully sorted in the laboratory where overwintering pupae were removed, counted, and checked for parasitization. Parasitic insects were also removed for subsequent counting, rearing, and identification. The sample areas were visually classified from the air as to the extent of defoliation at the time the pupal survey was made.

RESULTS

The aerial surveys revealed that over 1.1 million hectares (2.7 million acres) of paper birch in pure and mixed paper birch-white spruce stands were visibly defoliated during 1975 (Figure 1). This is more than double the area affected in 1974. Defoliation in the Interior extended from Tetlin Lake northwest to Tanana along the Tanana River and reached as far north as Livengood and extended as far south as Lake Minchumina (Maps 1-5). An insular area of defoliation on the west side of the Yukon River near Nulato extended from Koyukuk south to Big Eightmile Island (Map 6). Approximately 139,000 hectares (343,000 acres) were defoliated in southcentral Alaska. The area extended from Kashwitna Lake north to Talkeetna along portions of the Anchorage-Fairbanks Highway and from there nearly to Curry along the Susitna River (Map 7).

Pupal survey results for 1975 are summarized in Table 1. In comparing 1975 data with that of 1974 (Table 2), a decrease in population levels is apparent. The decline occurring during the late summer of 1975 was due primarily to increased larval parasitization and disease.

Figure 1. An annotated index to spear-marked black moth defoliation maps (Appendix).



Map No.	USGS quadrangle sheets (1:250,000) included 1/	Defoliation hectares (acres)
1	Tanacross & Mt. Hayes	56,000 (138,000)
2	Big Delta & Fairbanks	308,900 (763,200)
3	Livengood, Circle, Fairbanks & Big Delta	238,400 (589,000)
4	Tanana, Livengood & Kantishna River	139,400 (344,500)
5	Kantishna River & Mt. McKinley	195,500 (483,100)
6	Nulato	30,000 (74,000)
7	Talkeetna, Talkeetna Mts., Tyonek & Anchorage	139,000 (343,400)
Total		1,107,200 (2,735,700)

1/ There is some quadrangle overlap between maps; however, there is no duplication of acreage totals. This was done so the natural boundaries of spear-marked black moth populations could be more easily plotted.

Table 1. A summary of data collected during the fall pupal survey - 1975.

Sample number	Sample location	Degree of defoliation 1/	Mean no. of pupae per square meter 2/	Percent of pupae parasitized	Mean no. of braconid cocoons per square meter 2/
1	Mile 7, Chena Ridge Road	M	12.6	95	1.0
2	Mile 18, South Anch-Fbks Hwy.	L	9.0	89	1.3
3	Mile 19, North Anch-Fbks Hwy.	H	32.3	63	1.3
4	Mile 345, Old Nenana Road	H	40.6	75	2.6
5	Mile 14, Elliott Hwy.	M	8.3	76	1.3
6	Mile 17, Chena Hot Springs	L	1.3	100	0.0
7	Volkmar Lake	L-M	2.3	100	0.3
8	T-Lake	L	0.0	0	0.0
9	George Lake	M-H	3.9	100	4.0
10	Lake Healy	L-M	3.6	100	3.6
11	Quartz Lake	L-M	23.6	94	4.0
12	Lake Mansfield	M	17.2	97	4.3
13	Tolovana-Tanana River Jct.	L-M	1.6	81	21.6
14	Tanana River, Cosna Bluffs	L	0.0	0	0.7
15	"310" Lake	L	1.0	100	9.6
16	COD Lake	L-M	3.0	77	35.0
17	Bear Lake	L-M	4.0	100	27.6
18	East Twin Lake	L-M	1.3	69	15.3
19	Mucha Lake	L-M	0.3	100	0.6
20	Lake Chilchukabena	L-M	5.9	100	6.0
21	Lake Minchumina	L-M	3.4	100	11.7
22	Unnamed Lake near Bear Lake	L-M	0.9	67	6.3
23	Yukon River, 16 Mile Island	L	0.6	100	40.3
24	Blair Lakes	L	0.9	100	1.6
	OVERALL		7.4	82	8.3

1/ Ocular estimate from the air; L-Light, M-Medium, H-Heavy

2/ Average of three square-meter plots located 9.1 meters (30 feet) apart.

Table 2. A comparison of 1974 and 1975 pupal survey data 1/.

Defoliation classification 2/	Pupae per square meter 1974 3/	Pupae per square meter 1975 3/
light-medium	11.9	5.0
medium	15.4	10.2
medium-heavy	36.6	19.2
heavy	52.2	36.5
mean	24.4	7.4

1/ No parasitization data for 1974 fall pupal survey is available.

2/ 1974 defoliation classifications were ocular estimates made from the ground; 1975 classifications were made from the air. Some defoliation classifications were grouped to facilitate comparison.

3/ Figures include both healthy and parasitized larvae. Field observations indicate parasitization rates were substantially higher in 1975.

2/ Average of three square-meter plots located 9.1 meters (30 feet) apart.

DISCUSSION

Although historical information on outbreaks of this insect is limited, there are similarities in trend between this and the 1957-1958 outbreak when populations built up rapidly, remained high for two seasons, and then rapidly declined. Between 1973 and 1974, populations once again expanded rapidly, and by the time it was detected in 1974 the recent outbreak already covered more than 1.3 million acres. Further rapid proliferation occurred in 1975; however, the fall pupal survey indicated that during a peak year of defoliation, a substantial decrease in population levels occurred.

Decline of the 1957-58 outbreak was due to increased larval parasitization and disease (Downing 1959). A granulosis virus and two small parasitic wasps, *Meteorus* sp. (Hymenoptera: Braconidae), and *Aoplus* sp. (Hymenoptera: Ichneumonidae), were considered the dominant controlling factors at that time.

The rapid decline of the present outbreak also appears to have been caused by high larval mortality due to parasitization and disease. The two most common larval parasitoids were *Cratichneumon* sp. and *Aoplus* sp., both ichneumonids. The pathogens most commonly isolated were a granulosis virus, a fungus in the genus *Entomophthora*, and two protozoan species in the class Microsporidea. The moth defoliated birch in pure or mixed, even or uneven aged stands. In 1958, Downing stated that drainage bottoms were the most severely defoliated with lighter damage occurring toward the ridge tops. This was not apparent in 1974 or 1975.

The distribution on noticeable defoliation had shifted some from 1974 to 1975 as defoliation decreased west of Tanana and increased between Big Delta and Tok Junction. Even though the defoliated areas extended somewhat further east and west in the present outbreak, defoliation generally coincided with areas affected during the 1957-58 outbreak.

The effects of defoliation are being investigated by the Institute of Northern Forestry. Preliminary field observations indicated, however, that some twig or branch die-back had occurred on trees that were severely defoliated in 1974. It is expected that some growth loss has also occurred, as is the case with most hardwood defoliation, but it is not presently known how severe this loss will be.

CONCLUSIONS

The high incidence of parasitization and disease found during the pupal survey indicates that, overall, spear-marked black moth populations in the Interior will be considerably lower in 1976. Some scattered areas of noticeable defoliation are expected, however. The populations centered around Talkeetna may

not decline as rapidly. Although no pupal survey data was collected, this population has lagged behind the Interior outbreak by about one year with high populations first evident in 1975. Therefore, this area may experience another season of heavy defoliation before the populations decrease significantly.

Defoliation has been tolerable in light of current forest management intensity in Alaska's birch. Direct suppression of this insect has not, therefore, been recommended. Recent widespread natural declines in moth populations will allow defoliated trees to resume normal foliage development and growth. Forest Insect and Disease Management personnel will continue to monitor the spear-marked black moth populations in both interior and southcentral Alaska.

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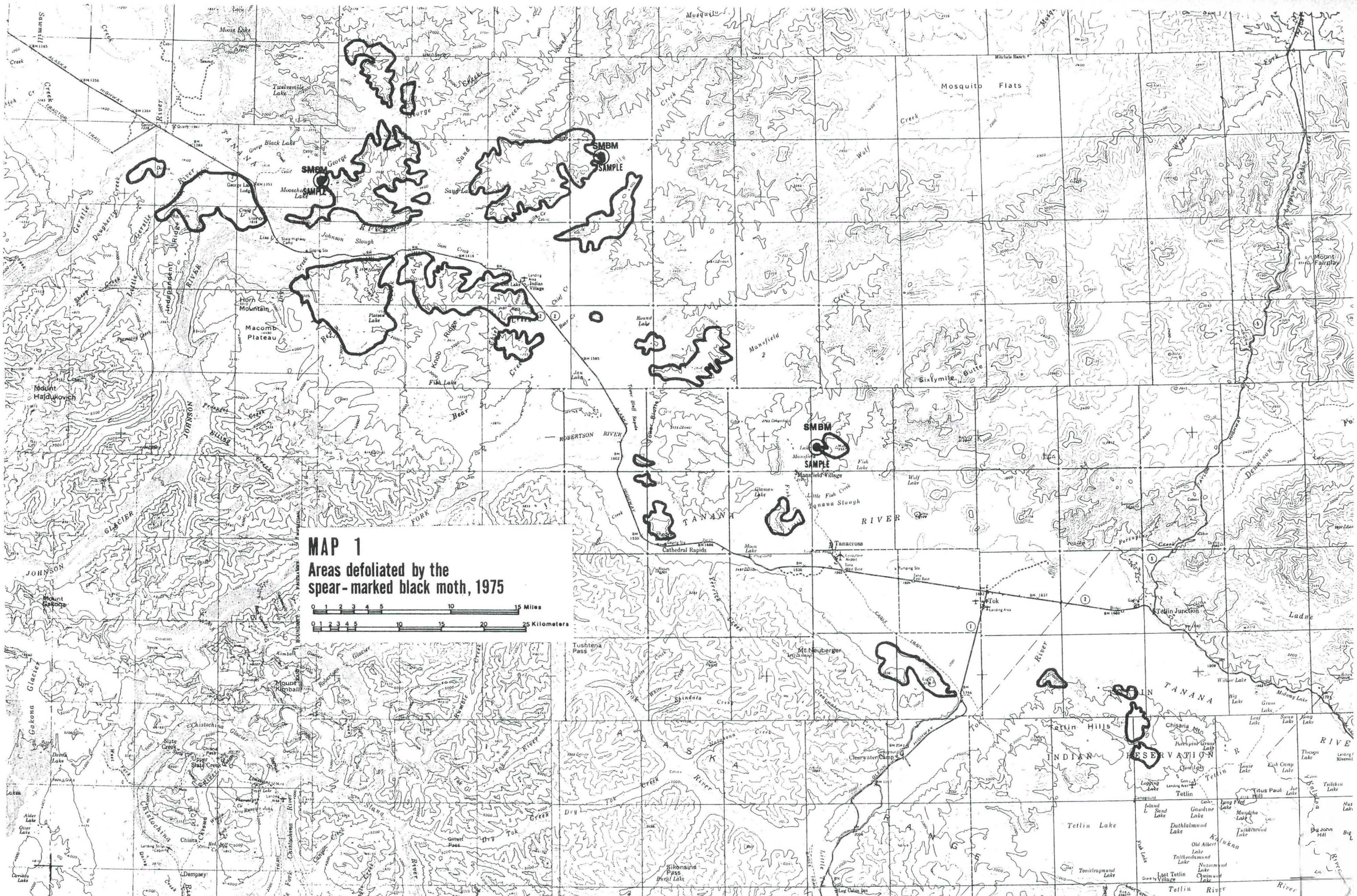
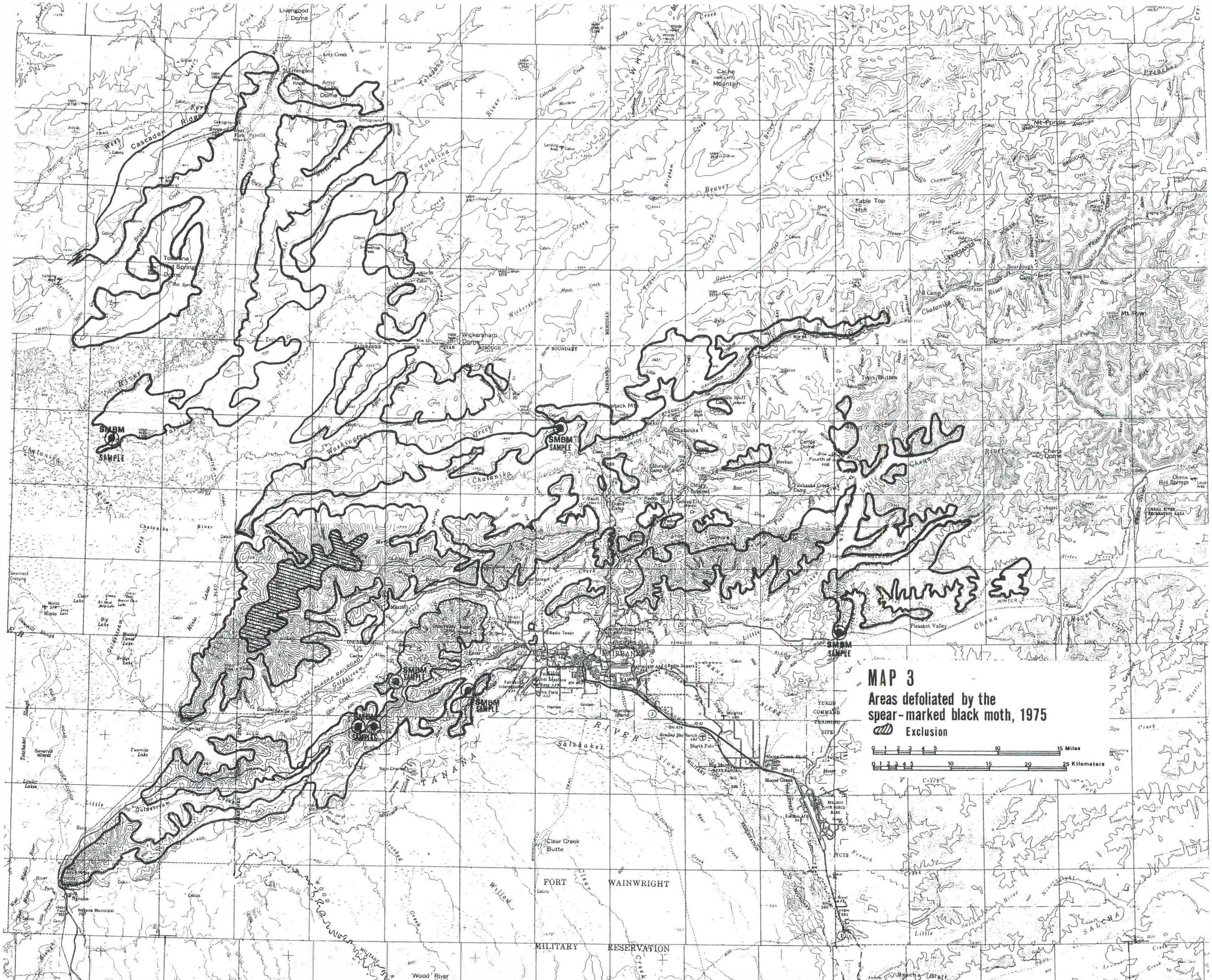
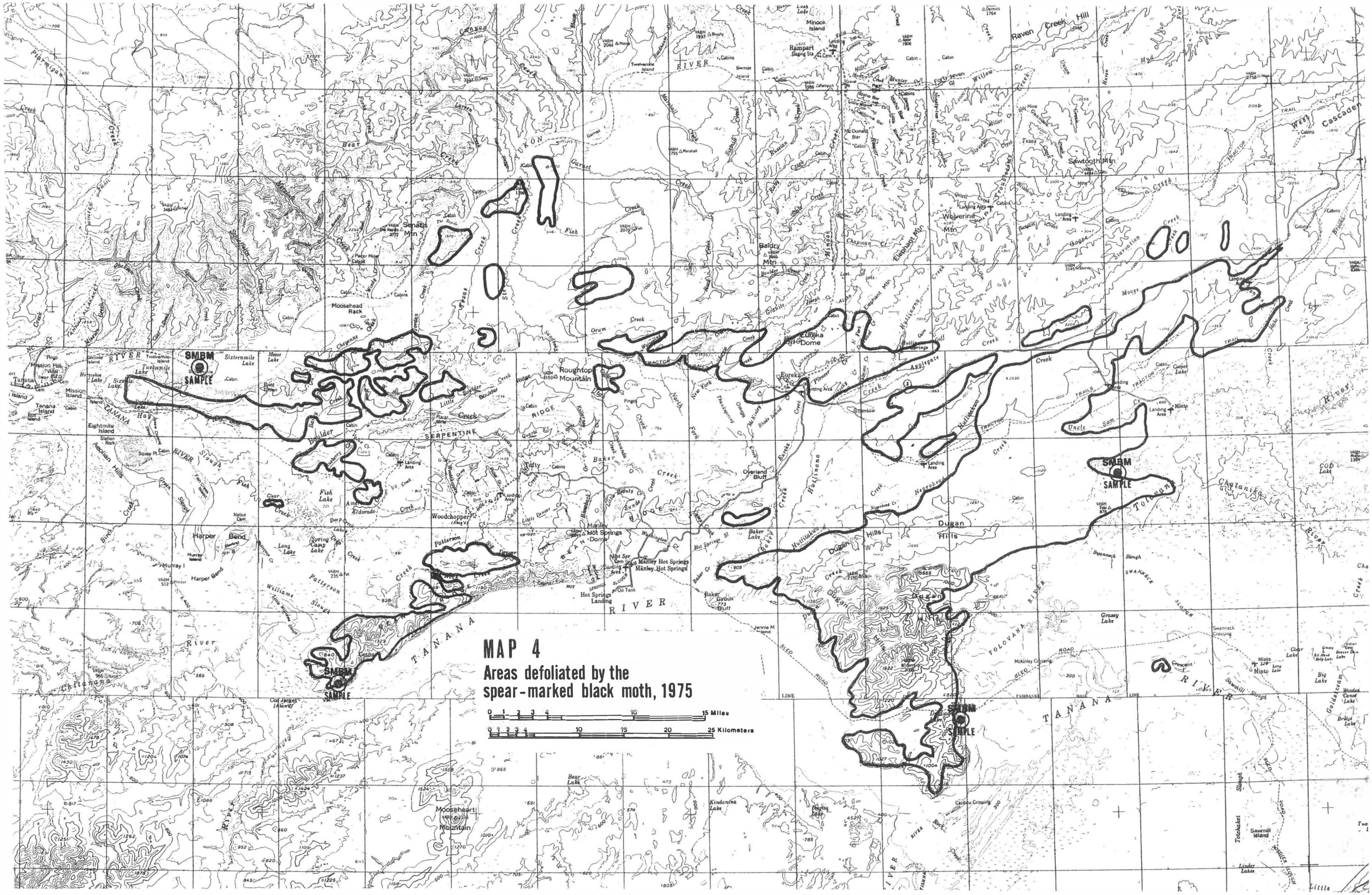
APPENDIX

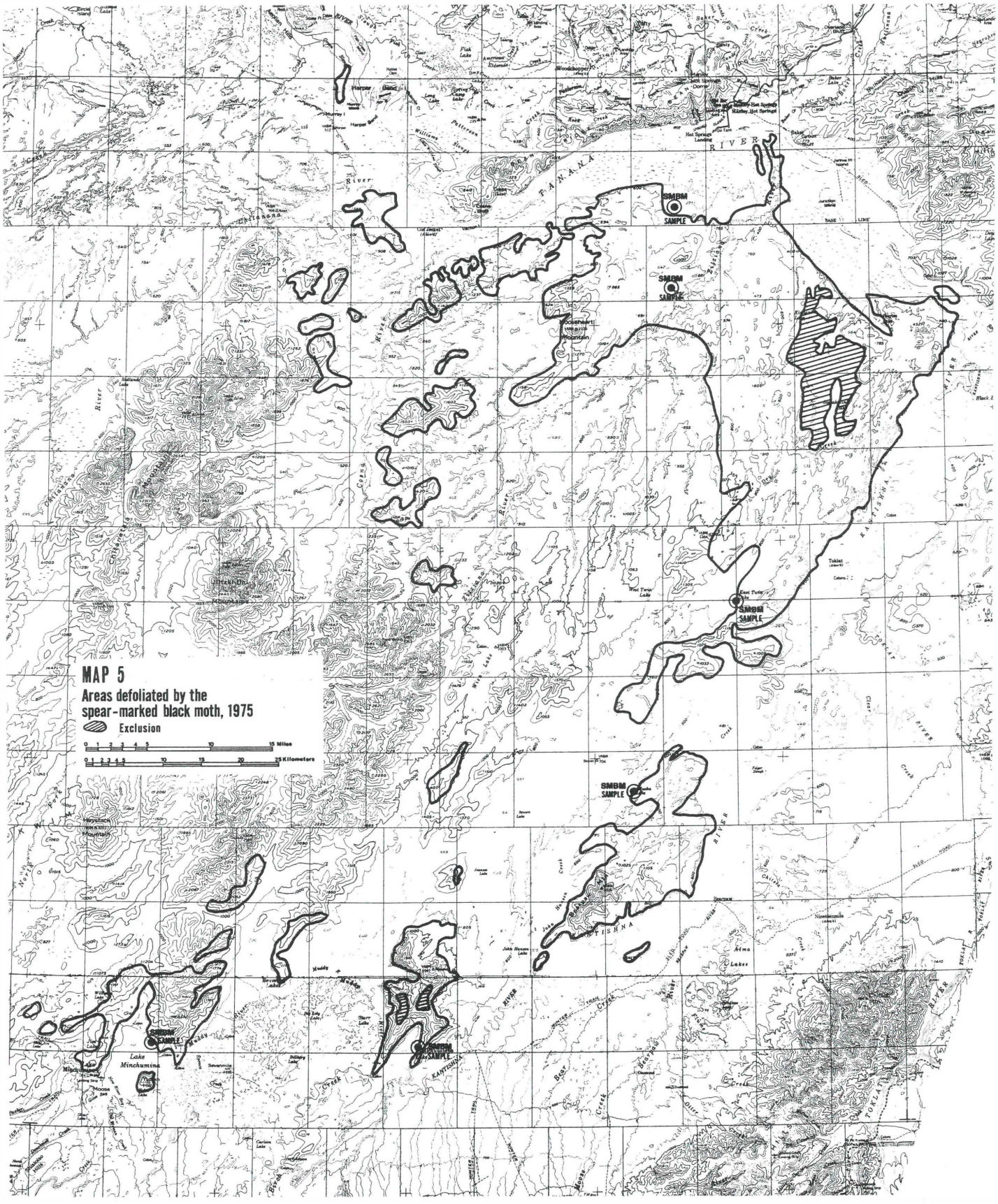

MAP 1
Areas defoliated by the spear-marked black moth, 1975
0 1 2 3 4 5 10 15 Miles
0 1 2 3 4 5 10 15 20 25 Kilometers
SMBM
SAMPLE
SMBM
SAMPLE
SMBM
SAMPLE
Mosquito Flats
Sixtymile Butte
Mount Fairplay
Tetlin Junction
Tok
Tanacross
Mansfield Village
Cathedral Rapids
Mt. Neuberger
Tushtena Pass
Horn Mountain
Macomb Plateau
Mount Hajdukovich
Mount Kimball
TANANA
RIVER
ROBERTSON RIVER
JOHNSON
GLACIER
INDIAN RESERVATION
Tetlin Hills
Tetlin Lake
Tetlin River
Sawmill

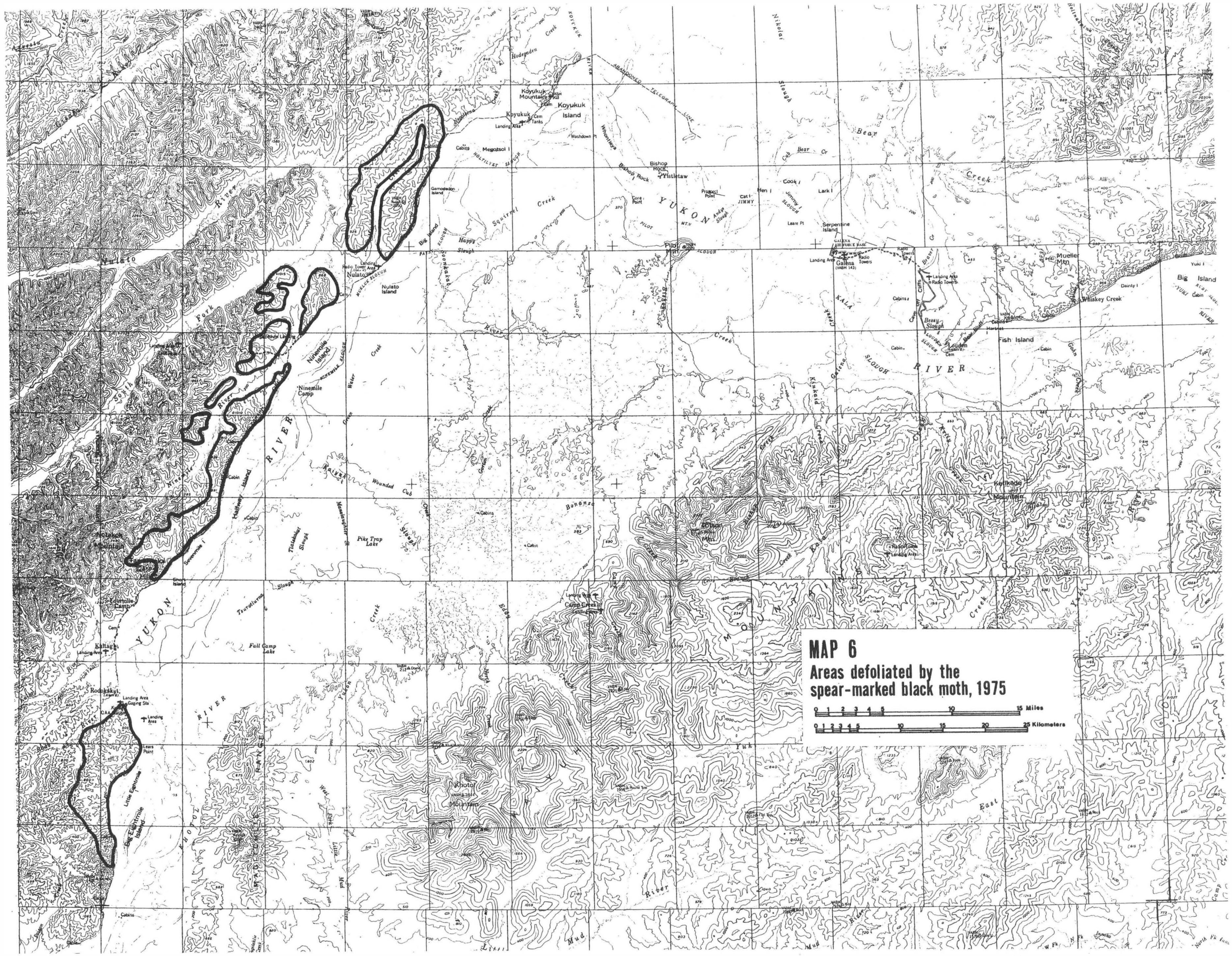

MAP 2
Areas defoliated by the spear-marked black moth, 1975
0 1 2 3 4 5 10 15 Miles
0 1 2 3 4 5 10 15 20 25 Kilometers
SMBM SAMPLE
SMBM SAMPLE
SMBM SAMPLE
SMBM SAMPLE
Pleasant Valley
Chena
YUKON COMMAND TRAINING SITE
SALCHA
RIVER
TANANA
RIVER
NORTH STAR BOROUGH
FAIRBANKS NORTH STAR
Harding Lake
Richardson
Shaw Creek Flats
Quartz Lake
Big Delta
Bluff Cabin Ridge
Goodpaster Flats
GOODPASTER
DELTA RIVER
Delta Junction
FORT GREELY
Clearwater Lake
Healy Lake
Healy River
Black Mountain
Shawnee Peak
Little Salcha
French
West Point


MAP 3
Areas defoliated by the
spear-marked black moth, 1975
Exclusion
0 1 2 3 4 5 10 15 Miles
0 1 2 3 4 5 10 15 20 25 Kilometers
SMBM SAMPLE
Livengood Dome
Amy Creek
Amy Dome
Cache Mountain
Cascaden Ridge
Tolovana Hot Springs Dome
Wickersham Dome
Table Top Mtn
Mt Prindle
Sourdough Camp
Mt Ryan
Twin Buttes
Chena Dome
Chena Hot Springs
Chatanika
Coffee Dome
Fourth of July Hill
Gilmore Dome
Pleasant Valley
Radio Tower
FAIRBANKS
YUKON COMMAND TRAINING SITE
North Pole
Moose Creek Bluff
Clear Creek Butte
FORT WAINWRIGHT
MILITARY RESERVATION
Wood River
TANANA
RIVER
Nenana Municipal
Standard
Twomile Lake
Big Lake
Minto Lakes
Chatanika River
Chena River
Salcha River
Little Salcha River
Goldstream Creek
THE ALASKA RAILROAD
FAIRBANKS NORTH STAR BOROUGH
MERIDIAN

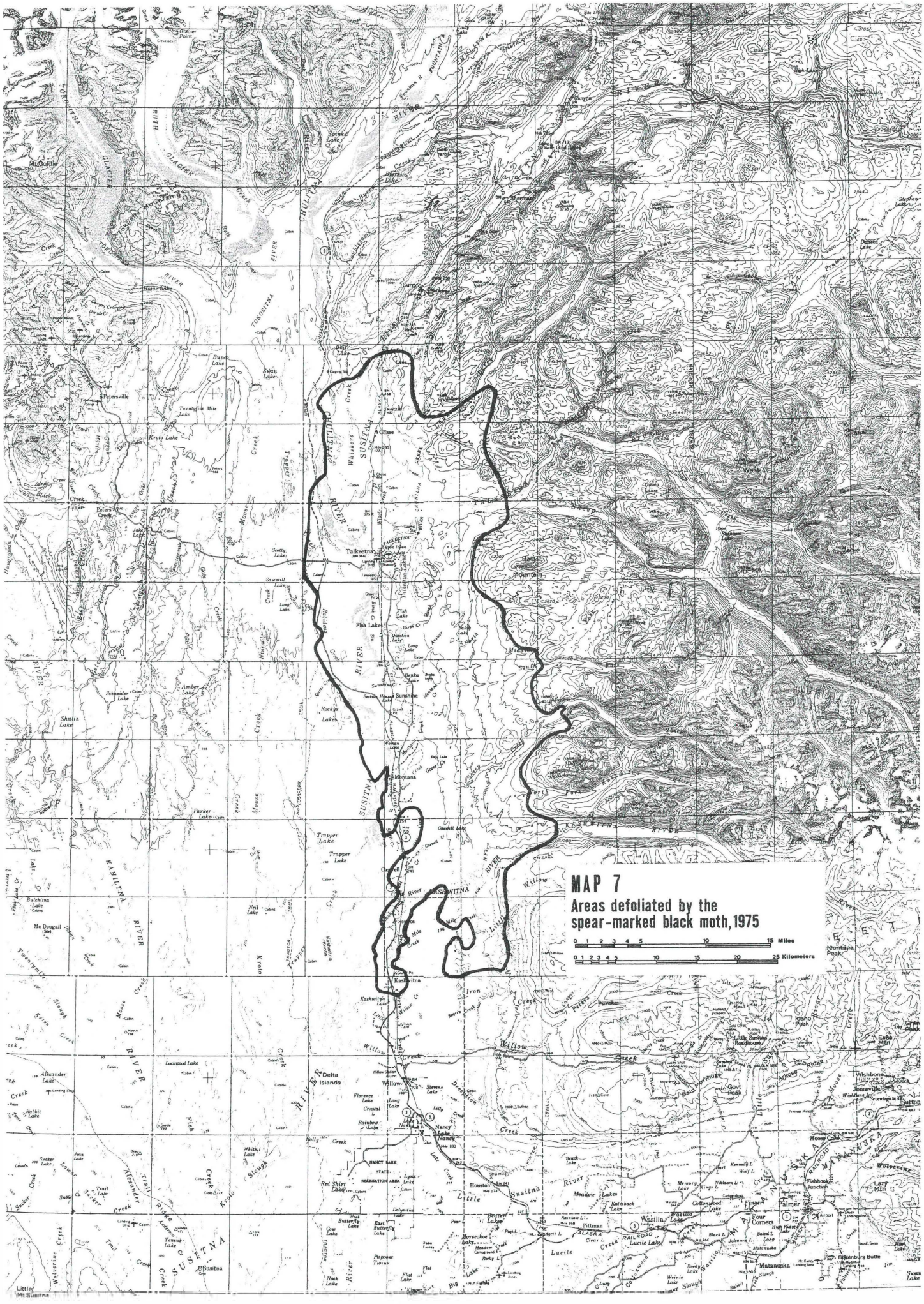


MAP 4
Areas defoliated by the spear-marked black moth, 1975


MAP 5
Areas defoliated by the
spear-marked black moth, 1975
Exclusion
0 1 2 3 4 5 10 15 Miles
0 1 2 3 4 5 10 15 20 25 Kilometers
SMBM SAMPLE
SMBM SAMPLE
SMBM SAMPLE
SMBM SAMPLE
SMBM SAMPLE
SMBM SAMPLE
PANAMA RIVER
KANTISHNA RIVER
Lake Minchumina



MAP 6
Areas defoliated by the spear-marked black moth, 1975


MAP 7
Areas defoliated by the
spear-marked black moth, 1975
0 1 2 3 4 5 10 15 Miles
0 1 2 3 4 5 10 15 20 25 Kilometers